DOCUMENT RESUME

ED 339 667 SO 021 676

AUTHOR McInerney, Claire; Park, Rosemarie
TITLE Educational Equity in the Third Wave: Technology Education for Women and Minorities.
INSTITUTION Minnesota Curriculum Services Center, White Bear Lake.
SPONS AGENCY Minnesota State Dept. of Education, St. Paul.
PUB DATE 86
NOTE 19p.
PUB TYPE Reports - Descriptive (141)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Computer Uses in Education; *Educational Opportunities; Educational Resources; *Educational Technology; Elementary Secondary Education; *Equal Education; *Females; Futures (of Society); *Minority Group Children; Racial Bias; Sex Stereotypes; Social Influences; Technological Advancement

ABSTRACT

Computers and other forms of technology are revolutionizing many aspects of society. U.S. education has sought to enhance the technological revolution, and to make computers available to students at all levels. However, in spite of wider availability, not all students are attaining equal access to computers and other items. This report seeks to understand the factors that have prevented female and minority students from using computers and to make suggestions as to what can be done to create more equitable access for all students. Research on why women and minorities do not participate with technology at high levels is discussed. Suggestions are made to teachers for increasing the participation of women and minorities with technology. Several suggestions are made to administrators including the establishment of a strong mentor program within the school district. Suggestions also are provided for parents. A 24-item annotated bibliography is included. (DB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

SO

EDUCATIONAL EQUITY IN THE THIRD WAVE:

Technology Education for Women and Minorities

ED339667

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

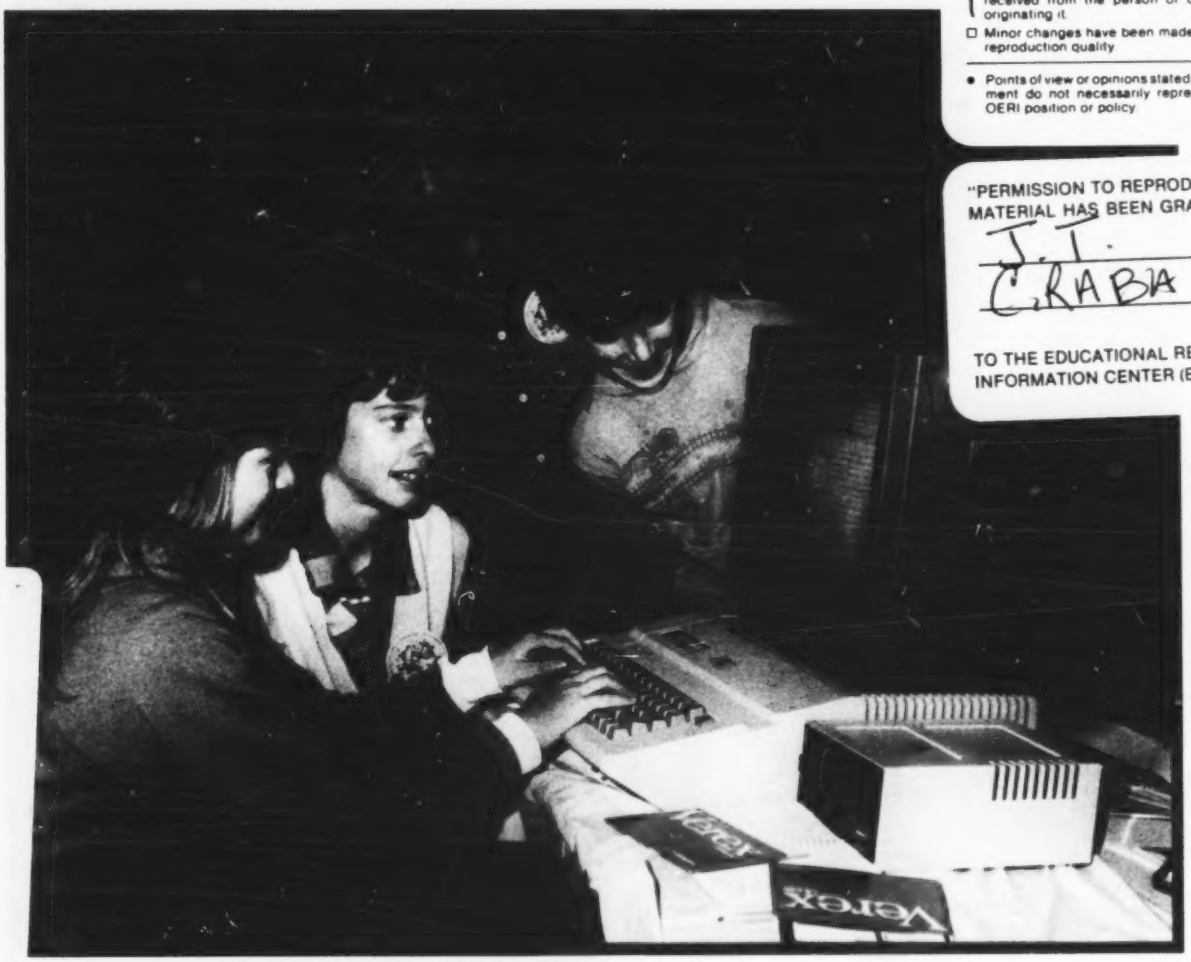
☐ Minor changes have been made to improve reproduction quality

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

J. I. CRABTREE

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."



BEST COPY AVAILABLE

Minnesota Department of Education

SO 021 676

The Minnesota Curriculum Services Center is supported by the State of Minnesota Department of Education and the State Board of Vocational Technical Education. The MCSC does not discriminate on the basis of race, color, creed, religion, sex, national origin, marital status, status with regard to public assistance or disability.

MINNESOTA CURRICULUM SERVICES CENTER
3554 White Bear Ave White Bear Lake, MN 55110
(612) 770-3943 800-652-9024

1818
6862500

EDUCATIONAL EQUITY IN THE THIRD WAVE:

Technology Education for Women and Minorities

Claire McInerney
College of St. Catherine

Rosemarie Park
University of Minnesota

Prepared under contract with the
Curriculum and Technology Section
Minnesota Department of Education
550 Cedar Street
St. Paul, MN 55101
1986

TABLE OF CONTENTS

Section	Page
Background	1
Key Issues	1
The Research: Why Women Do Not Participate in Technology	2
The Research: Why Minorities Do Not Participate in Technology	3
Inherent Sex Differences? Nature-Nurture?	3
Sex-Role Socialization	3
Suggestions to Teachers for Increasing Participation of Women	4
Suggestions to Teachers for Increasing the Participation of Minorities	5
Suggestions for Administrators	5
Encourage Development of Non-Biased Software	6
Access to Computer	6
Use of Equipment During Non-Traditional Times	7
Organize a Task Force on Technology Education Equity	7
Suggestions for Parents	7
Summary	8
Bibliography	9
Footnote References	13

BACKGROUND

Futurist Alvin Toffler described a new age, a new society by taking a striking look at the 1980s and beyond in The Third Wave. His glimpse into the electronic cottage where employees work at home, linked to their corporate base by a microcomputer, has become a reality for many families, especially those with the resources to buy a computer and with the education to hold a white collar job that adapts readily to an electronic workstyle. Although many of Toffler's forecasts are proving to be accurate, there is growing evidence that women and minorities may not be finding equitable places in the new wave of work and societal institutions.

The most revolutionary element of the new civilization that Toffler pictures is the rapid growth in technology research and application. Current changes in communications, travel, banking, manufacturing, and everyday living can be traced directly to the steady development and refinement of the semiconductor chip and its powerful and varied applications. It is in the technological marketplace where the opportunity lies for new kinds of careers.

American education has openly embraced the technological revolution rushing to make computers available to students at all levels. In the enthusiasm to provide equipment, however, important issues of equity are in danger of being ignored. One of the most serious problems educators have yet to face is the fact that computer education has become the privilege of middle-class white boys (Campbell, 1984). Studies show that in 1983, 67 percent of the more affluent public schools owned computers, but only 41 percent of the poorer public schools had them (Ascher, 1984). In addition to school use, middle-class parents sent many of their children to summer computer camps, to after-school and weekend programs, and in fact, often bought computers for their children to use in their own home. The enrollment ratio of boys to girls in computer camps (where tuition is usually several hundred dollars) is now three boys to every one girl (Phi Delta Kappa, 1983).

KEY ISSUES

Educators are learning that just having the machines in a school does not guarantee equitable access to computers or other items. There is an "access gap" between the "haves and the have-nots" which threatens to become even wider. Statistics in a study conducted in 1983 show that affluent schools in urban areas had a computer for every 91 students, whereas in poor urban schools there was one computer to every 137 students. In wealthier rural schools, the study showed one computer to every 63 students, but poor rural schools had one computer to every 88 students (Campbell, 1984). What do the numbers mean as far as the students are concerned? Obviously, the fewer the computers to go around, the less time there will be for each student's use.

Too few computers increases the danger that the most aggressive and the most vocal students will find a place at the computer terminal; the reticent will hold back, and some will never get a turn at all. Girls generally shy away from situations where they must fight for their right to use a piece of equipment, so they are often left standing on the sidelines when computer time is severely limited. The problems of rural poverty, general accessibility, and lack of interest in computer technology by some parents living on medium to small family farms should be addressed. The attitude of "this is the way my daddy did it" still prevails.

In addition to the question of access is the issue of how the computer is being used in the learning process. There is strong evidence to suggest that schools with high concentrations of minority students use the computers for drill and practice, but schools with wealthier white populations emphasize computer programming (Concerns, 1984). Programming has also been taught in special programs for the gifted and talented, and in some schools, computers have been reserved for the more talented students. In expressing its concern regarding equitable treatment of all children in computer and technology education, the Council of Chief State School Officers issued this statement:

> The key question from an equity standpoint is whether the distribution and use of microcomputers favor any particular group. If conditions of access and use by virtue of socioeconomic status, sex, race, or disability assist some students in learning to master the computer and develop learning only to follow the commands of the computer in drill and practice sequence, the cause of educational equity is not well served (ibid.).

Distribution and use are important items on the equity agenda, but the software that is used is crucial as well. Available software clearly influences how computers are used and who uses them in a school setting. For many students and teachers, computer education means math education, because micros are used exclusively to teach "number crunching" or mathematical problem solving. Although math-related uses are certainly a legitimate use of computers, students who already experience math anxiety (traditionally, a large percentage are girls), computers are regarded as another phobia to be avoided.

There is also an alarmingly high assortment of violent and competitive programs in classroom use. "Math Invadors," "Big Math Attack," "Duelling Digits," only reinforce the idea that computers are macho male territory -- no girls allowed! The video arcade has been called the last bastion of male turf, and the militaristic, shoot-em-up nature of many pieces of educational software carry on the worst of video arcade tradition. Games are a salient way to introduce computers to the reluctant student, but male-oriented games only serve as "turn-offs" to girls who might be just the ones the teacher is trying to reach (Campbell, 1984).

The Research: Why Women Do Not Participate in Technology

A review of the research (Assoc. of American Colleges, 1982) and interviews with experts in the field suggests the following factors as barriers to participation of women in technology. First is sex-role stereotyping. Sex-role stereotyping, especially for adolescent girls, continues to be a powerful factor in deterring participation in technology. Second, there is a lack of adequate role models for girls, especially in elementary school where they do not see women successfully involved with technology. Third, there is reticence on the part of female elementary teachers to use and participate in technology. Most elementary teachers are women. Many as yet feel uncomfortable using technology in the classroom. Fourth, many female elementary teachers report (Glenn, 1985) they feel uncomfortable in the areas of science and math and lack confidence in their ability to teach these subjects. Fifth, there is the perception that science and math are "male subject areas." There is a mistaken idea among some teachers that technology is only usable in science and math subject areas, both of which are seen as predominantly "male" subjects. Sixth, teachers unconsciously reinforce sex stereotyping by assuming boys will be more interested in technology than girls.

The Research: Why Minorities Do Not Participate in Technology

A review of the research and interviews with experts in the field suggest that the following factors act as barriers to the participation of minorities with technology (Campbell, 1984). First, as mentioned above, access is a major issue. Minorities predominantly go to school in less wealthy school districts; these districts do not have the funds to buy adequate or state of the art technology. Access is further impeded by the fact that minority families are overrepresented in the ranks of the poor. Poor parents cannot afford to buy home computers for their children. Second, is the lack of role models. Role models are needed to show that minority men and women can succeed in careers involving high technology. Third, materials are inadequate. Some researchers report that minorities often are exposed to technology in remedial programs. These programs consist of "drill and practice" exercises rather than the use of technology in creative problem solving. A fourth factor may be fear of technology in the workplace. Many minority parents fear technological change in the workplace since such changes have led to the phase-out of jobs traditionally held by minorities. This attitude of fear also communicates itself to their children. Fifth, de facto segregation still occurs. Tracking and assignments to specific curricular areas still result in relegating minorities to lower tracks with fewer academic programs with less access to technology. This is not always conscious policy on the part of school administrators. Sixth, as with women, unconscious stereotyping may still be a factor in keeping minorities from being challenged academically. Teachers may expect less of some minority students, leading them, in turn, to perform less well. Last, where access to the technology is poorly supervised, the computers are sometimes taken over by one particular group to the exclusion of others. This can result in less aggressive minorities, such as Native American children, being left out.

Inherent Sex Differences? Nature-Nurture?

Much of the early research attempting to account for differences in performance on science and math achievement tests between girls and boys looked for inherent traits. Research by Kagan et al. does show some differences in the way newborns respond to verbal and nonverbal stimuli. Generally, females show more responsiveness to verbal stimuli than do boys (Mussen, Conger and Kagan, 1969). Maccoby and Jacklin report that boys out-perform girls in tasks requiring visual and spatial skills, especially depth perception (discriminations in three dimensions) when asked to solve mazes (Maccoby and Jacklin, 1983). However, much of this research is controversial and open to various interpretations. Many researchers argue that parents treat boys and girls differently from birth. Mothers talk to daughters more while preferring physical interaction with boys (Pelcak & Hansen, n.d.).

Sex-Role Socialization

Research documenting poorer performance in science and math measures is certainly not new. Tyler reports as early as the 1950s that girls tend to do best on verbal measures, whereas boys do best on quantitative or spatial problems. But Tyler and most recent researchers see these differences as a result of sex-role expectations. Studies of sex-related ability in mathematics by Fennema at Wisconsin conclude that differences in mathematical performance of boys and girls are determined almost entirely by socialization. These differences in socialization overwhelm any differences in responses to verbal and nonverbal stimuli noted in neonates (Fennema, 1984).

Age, as an important factor in sex-role stereotyping, is supported by two local studies at the University of Minnesota. In a study of fourth-, fifth-, and sixth- graders, Glenn found no differences in boys' and girls' attitudes toward science, math, and computers on most of the questions he asked (Glenn, 1984). However, studies of adolescent girls by Hedin, also of the University of Minnesota, found girls very ambivalent in their attitudes on sex roles. Intellectually, teenage girls see the necessity of succeeding, but emotionally want to be taken care of. Elementary students thought it was all right for girls to be good at math and to use computers. By the time adolescence sets in, however, some girls were not so sure. This may account for the fact that differences in mathematical performance between boys and girls are more marked at grade 11 than grade 4 (Pelcak and Hansen, 1977).

By and large, the research is optimistic about changing the teachers' and the students' attitudes toward sex roles. A review of the research on sex-role stereotyping by the staff of the Born Free Project at the University of Minnesota concludes that teachers do change behavior that is the result of unconscious sex stereotyping when they are sensitized to the problem (Pelcak and Hansen). The research also points out that sex-role identification takes place at ages three and four, before the child even enters school (Pelcak and Hansen, 1977).

The research also indicates the importance of exposing elementary-age children to both male and female teachers. The interaction of both male and female teachers in the classroom has a beneficial effect on all the children in the class. The following section summarizes suggestions for teachers, administrators and parents.

Suggestions to Teachers for Increasing Participation of Women

Elementary teachers need to be sensitized to the fact that they may still unconsciously be discouraging girls from being actively involved with classroom computers and other technology. Workshops that create an awareness of the problem perhaps give teachers an opportunity to monitor their own behavior and that of other teachers to evaluate whether or not they do expect less from girls in regard to competence in science and math and with technology. To attract teachers with life licenses, inservice needs to be applicable to their subject areas and college credit should be offered.

Teachers should also be given specific training in designing curriculum that is free of gender bias. Teachers badly need help in designing software for computers to meet the specific needs of their own school districts. Helping teachers generate software and other classroom materials free of gender bias might also help ameliorate some of the fears that teachers have in regard to technology.

It is important that teachers feel competent and at home with computers and other technology. As Glenn points out, women teachers feel uncomfortable both with the technology and, in the case of elementary teachers, with teaching science and math. Once women elementary teachers themselves feel confident, then they can provide the role models girls in elementary school so badly need in order to become interested in science and math.

Finally, computer companies must be willing to give prolonged in-services to teachers (not administrators) to help them accommodate the technology. In these workshops, companies should stress that computers are wonderful teaching and classroom management tools designed to complement what a teacher does, not replace it.

Companies must also revise software so that it has appeal to both males and females. Illustrations and offline materials should show women interacting with technology.

Suggestions to Teachers for Increasing the Participation of Minorities

As with women, teachers may have lower expectations for some minority groups. A conversation with Jan Withune of the Minneapolis Public Schools suggests this may be a particular problem for Native Americans. Workshops should deal specifically with teacher expectations for minority success with science, math, and technology rather than be general human relations courses.

Teachers also need to understand the different value systems of various minority groups and where conflicts in values might occur. For example, much computer software is written with an aggressive, competitive "I'm in charge" style that Native Americans find difficult to relate to. Teachers might find cooperative strategies for computer use and less threatening courseware more appropriate for some minority groups.

Helping teachers develop diverse teaching strategies will help them meet the needs of all children in the class. Minority group children would especially benefit. Teachers need help in developing teaching strategies to integrate technology with their classroom teaching.

Suggestions for Administrators

Establish a strong mentor program within the school district. Because mentors play such an important role in developing success-related characteristics in young people, schools would do well to organize an effective quality mentor program for students, especially those in high school. A teacher who is given half time as a release in order to organize and implement an effective mentor program is an investment that will produce many returns.

The mentor coordinator will contact individuals in the community willing to serve as mentors. Contracts, times, and other details will be arranged between the students and the mentor, with the mentor coordinator acting as facilitator and supervisor. If the students' work can be monitored carefully and if the work is of sufficient academic quality, high school credit can be awarded, thus encouraging students to participate.

Through a mentor program, students can have the opportunity to work in a scientific laboratory, an engineering firm, a television studio, a high tech manufacturing firm, or a computer-based service industry. The student will see firsthand what kind of skills are necessary for certain jobs, and he or she will be able to analyze the career in light of a real-life experience. It can also provide the opportunity for an especially talented student to advance in an area where the school curriculum is limited.

Finding high tech mentors may be a problem in some areas of Greater Minnesota because of the lack of high tech businesses located nearby. Successful women and minority individuals from the metropolitan area might be willing to travel to other parts of the state with reimbursement of expenses. The Minnesota Alliance for Science has a statewide listing of individuals, as does Women in Computing.

Encourage Development of Non-Biased Software

Textbook selection committees can expand their role to include the careful evaluation of computer software. Students, teachers, and parents, along with curriculum experts, can search out challenging and exciting software packages that present learning in a non-sexist light. Some software developers (MECC in Minnesota) are making concerted efforts to produce computer packages that include culturally diverse themes while at the same time avoiding sexist language and sexually biased themes. Additional funding needs to be made available for further developments in appropriate software.

Media materials (films, slide shows, etc.) highlighting interesting role models, career opportunities, and the positive aspects of the technology revolution need to be designed and produced for use in rural schools, individual classrooms, and by parent groups in an effort to raise consciousness and open minds.

Access to Computers

The way that technology is used in labs and classrooms must be closely supervised. If computers are only available in advanced science and math classes, some children will have much less access to them.

Administrators must make sure that equipment does not belong to one department (for example, the math department). Computers, video equipment, modems, etc., are ideally housed in neutral territory, such as the school media center, so that access is possible for all. Even if it means enlisting the help of volunteers or paid helpers, equipment should be made available before and after school.

Some school districts also have "loaners." Certain computers are set aside for parents, children, and teachers to take home. Parents sign for the equipment and get a brief run-through on the do's and don'ts, and away they go. In schools where computers are loaned, little damage results and much success has been reported.

Enough equipment must be provided so that a free-for-all or access-to-the-strongest policy does not prevail. There's nothing wrong with two students to a computer. Sometimes the synergy of two working together actually produces better results than a student alone at a computer. However, if there is only one computer to a classroom or to a school, there are problems. A sign-up system can be established, but sometimes with "sign-ups" girls will wind up giving their allotted time away to the boys to avoid being pestered by them. Teachers need to be careful that this doesn't happen. No one should be bullied into losing his or her chance at the equipment.

Use of Equipment During Non-Traditional Times

Many schools have opened their computer labs to community education classes one or two evenings a week. There are other times when equipment could be utilized as well, thus greatly expanding accessibility of the machines:

- By hiring a high school or college student as student consultant, schools could have the computers available in the late afternoon, early evenings, and Saturdays. Computers are very durable machines and can take this increased kind of use. Surge suppressors and fans can be purchased to help the machines endure expanded use. Parents and students could come together in the evenings to use their own software.

- Schools and public libraries can work out a cooperative arrangement whereby certain machines are made available in the summer time in the public library. Also, school libraries/media centers with computers should be open part-time in the summer, probably in conjunction with summer school. This way students could keep up their skills during the long summer months. Older people in the community would have access to the computers in a place where they feel comfortable and are accustomed to going for information.

- Latch-key programs are being organized in many school districts. One option as part of a latch-key program could be classes in computer programming and video production. The schools' computers and video equipment could then be used by more students.

Organize a Task Force on Technology Education Equity

Parents, teachers, administrators, and students in local educational agencies should have a committee to serve as watchdog in the school system. This committee can search out useful information for school personnel to help them stay current on developments in hardware and software products. Other functions for the task force could include developing an evaluation process to ensure that optimum learning takes place in an equitable manner. Easy-to-use record keeping systems can be suggested so that school staff can monitor use of technology programs by sex, race, national origin, and disability, as well as by mainstream students.

Suggestions for Parents

Parental stereotypes of women in science are longstanding. Boys generally are encouraged to explore mechanical and scientific pursuits at an early age, girls are more often directed toward artistic and literary endeavors. Parents often allow their boys to attend computer camp when they express interest, since they reason that boys are more likely to go into career paths requiring computer skills (science, math, engineering).

Parents a generation ago seldom knew a woman doctor or minority lawyer; therefore, it was less likely for them to encourage their children in professional careers if the child was a girl or from a minority family. Mothers and fathers today need exposure to women and culturally diverse workers from high tech industries via films, slides, or other visual representations.

Since counselors traditionally invite parents of seniors to school to explain college entrance procedures and financial aid forms, the senior "meeting" can be expanded to demonstrate career options to parents and students. The senior seminar series can include visiting scientists, and films and slide programs. If possible, the counselor/parent meetings should take place earlier in the student's high school career.

Parents of younger students need information also. Thirteen is the pivotal age in the development of strong likes and dislikes of subject areas for young people (Rogers, 1984).

> Most observers note that boys are attracted to computers more strongly than girls. If children's use of computers and video games teaches them useful skills for living in an information society, males are getting off to a faster start. In the U.S., girls have equal ability to boys in math and science until around age 12 (sixth grade), thereafter girls often develop a negative attitude toward these subjects and avoid them in high school, thus limiting their career opportunities.

The reasons for the development of this negative attitude toward math and science by girls around age 12 should be analyzed.

Because students develop prejudices at such an early age, schools should reach parents while their children are still young. Science fairs, inventors fairs, and other special activities such as field trips to science centers, can all help to encourage interest in science among all students, especially if teachers and administrators take special pains to invite all students to participate. More emphasis than usual can be placed on such projects by sending special letters home inviting parents to a pre-project meeting; enlisting parent help by explaining all the details; assigning a teacher (with extra pay) or enlisting volunteers to work with the students after school in organizing their work for a fair; having science practitioners available at PTA meetings to explain the kind of work they do. Programs could be offered for parents and preschoolers which would introduce them to the computer and provide opportunities for them to become familiar with the technology and the programs available.

SUMMARY

The waves of change are indeed causing activity, uncertainty, and exciting new ways of working, living and socializing. If education is going to ride Toffler's Third Wave into the future of the late twentieth century, technology education will have to be made equitable for all children.

BIBLIOGRAPHY

(The works preceded by an asterisk * are concise and to the point. Together they would make appropriate seminal works to be included in an in-service for educators.)

Ascher, Carol. Microcomputers: Equity and Quality in Education for Urban Disadvantaged Students. ERIC Clearinghouse on Urban Education, January, 1984.

[An excellent source of statistics on equity in relation to urban schools and rural schools as well as wealthy and poor school districts.]

Association of American Colleges. Project on the Status and Education of Women. The Classroom Climate: A Chilly One For Women? February, 1982.

[Although the research on which this position paper is based pertains most directly to the differences in postsecondary education for men and women, it is one of the most thorough and specific treatments of ways teachers treat the sexes differently. From classroom communication, informal exchanges, to expectations, examples are given showing how teacher behaviors influence women in their education and career aspirations.]

Bumstead, Richard. "Opening Up High Technology Careers to Women." American Education. April, 1980, pp. 25-29.

[Project ACT (Access to Careers in Technology) is highlighted showing how women in dead-end, low paying jobs were retrained and given the confidence to succeed in higher paying technical careers. Conducted in the Boston area, women attended classes in technical fields; they were also given training in assertiveness, resume writing, and job interviewing.]

*Campbell, Patricia B. "The Computer Revolution: Guess Who's Left Out?" Interracial Books for Children Bulletin. XV, 3, 1984, pp. 3-6.

[One of the best articles on the subject of equity for female and minority students in computer education. Campbell gives statistics, cites examples, and gives helpful suggestions. One of the most readable works on the subject.]

*Council of Chief State School Officers Resource Center on Sex Equity. "A Concern About Computer Equity." Concerns, June, 1984.

[Every school board member and educator interested in the equity in technology education issue should have this document as a handy reference. Its main value lies in the selective list of resources, references, legislation, and research summaries. Addresses are included for most sources. Concerns can be obtained from: CCSSO Resource Center on Sex Equity, 400 North Capitol Street Northwest, Suite 379, Washington, D.C. 20001 (202) 393-8159.]

Enos, Clive and Sondra Forsyth Enos. "Portrait of the American Woman Today." Ladies Home Journal, January, 1984, pp. 122-128.

[Despite its non-academic origin, this is a comprehensive survey of the American woman, circa 1984. Good statistics on women working outside the home are included.]

Erb, Thomas Owen. "Attitudes of Early Adolescents Toward Science. Women in Science, and Science Careers," Middle School Research, Selected Studies. National Middle School Association, 1981.

[A research study that points to the importance of the adolescent and pre-adolescent years in making a choice of careers.]

Foreman, Judy. "Wellesley's New President: The Right Woman For the Right Job," Change, April, 1982, pp. 42-46.

[An interview with Nannerl Overholser Keohane, Wellesley College's president, illuminates her plan to integrate "technological literacy" into the curriculum. Adamant on the subject of technology education for women and minorities, Keohane talks about the danger of technologically illiterate ghettos. The article also tells how Sloan Foundation money is being used to incorporate technological studies and instruction in quantitative methods into the traditional curricula.]

Interview with Professor Allen Glenn, Chair, Department of Curriculum and Instruction, 145 Peik Hall, 159 Pillsbury Drive Southeast, University of Minnesota, Minneapolis, MN 55455.

Goldfield, Randy. "New Office: The Entrepreneurs (High Technology Companies Run By Women)," Working Woman, February, 1983, pp. 45-57.

[Case studies of women who have "made it" in high technology careers.]

Hanauer, Mark. "A Friendly Frontier for Female Pioneers (Women in Computer and Software Industries)," Fortune, June 25, 1984, pp. 78-86.

[An optimistic look at opportunities for women in the computer industry.]

Maccoby and Jacklin cited in Sex Differences in Computer Training: Why Do Boys Outnumber Girls? Research Bulletin, Phi Delta Kappa, May 1983.

*Malcolm, Shirley M. "Women-Minorities in Science and Technology," Science, October, 1981, p. 137.

[Malcolm makes a cogent point in this concise editorial; she says that science has not been served well by prejudice and discrimination in the field. As a result, science has lost the talent that could have been applied to research by women and minorities. She contends that this waste of brainpower could be turned around by better training, more rigorous education and more federal dollars to assist in recruiting and training more women and minorities in science.]

Martin, Josh. "Brave New Managers," Working Woman, May, 1983, pp. 100-105.

[Another look at women who have been successful leaders in the high tech industries. Good reading for girls making career decisions.]

Meyers, Mike. "3M Engineer Aims to Help Girls Fit into Math Studies Equation, "Minneapolis Star and Tribune, July 2, 1984, p. 2M.

[A close-up of one of the 3M women scientists who travel to schools and encourage girls to choose science careers.]

Moss, Carol M. "Integrating the Computer Circuit," Citibusiness, May 9, 1984, p. 10.

[The author analyzes the mainframe and microcomputer industries in order to find the specific jobs that are appealing and open to women. She concludes that communications computer applications is one place women find comfortable.]

Mussen, Conger, Kagan. Child Development and Personality, 1969. Harper Row, New York.

O'Connor, Rory J. "Q & A: Ann Winblad," Infoworld, July 11, 1984, p. 66.

[Interview with a self-made high tech entrepreneur who at a young age made a fortune in the computer software business.]

Pelcak, Douglas, and L. Sunny Hansen, Director, Project Born Free. Selected Review of the Literature on Career Development and Sex-Role Stereotyping at the Elementary Level. Counseling and Student Personnel Psychology, Department of Psychoeducational Studies, College of Education, University of Minnesota, Minneapolis, MN 55455.

*Phi Delta Kappa, Center on Evaluation, Development and Research. "Sex Differences in Computer Training: Why Do Boys Outnumber Girls?" Research Bulletin, May, 1983.

[A brief two-page summary of the research about inequities in computer training in schools. The piece does not make any recommendations or offer solutions, but it does dispel some myths (about neurological differences) and could be used as an excellent consciousness raising tool.]

Rogers, Everett M. and Judith K. Larsen. Silicon Valley Fever: Growth of High Technology Culture. New York: Basic Books, 1984.

[A readable account of a new kind of culture evolving in the high technology industry. A section is devoted to women and one to minorities and the places they have found in the industry. Reading this book is a fast way to immerse oneself in the high tech culture, and to get a feel for the rapidly changing high tech job market. One significant truth that emerges from the book is that white males can rise to top jobs in the computer field without significant previous training in computers.]

*Turecamo, Dorrine. "Education: Visiting Scientists," Working Woman, September, 1983, pp. 116-118.

[A detailed look at how the visiting scientist program sponsored by 3M works, and how it has been implemented in Minnesota and other parts of the country.]

U.S. Department of Education. The National Institute of Education. Sex Equity in Education. NIE-Sponsored Projects & Publications. Washington: U.S. Government Printing Office, 1981.

[A list with descriptions of research projects and curriculum projects intended to achieve sex equity. Contact persons with addresses and phone numbers are included.]

"Why Not Womanpower?" Electronics, July 14, 1983, p. 182.

[Electrical engineers speaking to their colleagues advocating strong and determined efforts to include more women in engineering schools and the workplace. The editorial appeals for more communication between business and schools, more publicity about opportunities for women, more scholarships for women, and an elimination of the traditional barriers (discrimination and prejudice) in the profession.]

FOOTNOTE REFERENCES

Aschner, Carol. Microcomputers: Equity and Quality in Education for Urban Disadvantaged Students. ERIC Clearinghouse on Urban Education, January, 1984.

Association of American Colleges. Project on the Status and Education of Women. The Classroom Climate: A Chilly One For Women? February, 1982.

Bumstead, Richard. "Opening Up High Technology Careers to Women." American Education. April, 1980, pp. 25-29.

*Campbell, Patricia B. "The Computer Revolution: Guess Who's Left Out?" Interracial Books for Children Bulletin. XV, 3, 1984, pp. 3-6.

*Council of Chief State School Officers Resource Center on Sex Equity. "A Concern About Computer Equity." Concerns, June, 1984.

CCSSO Resource Center on Sex Equity, 400 North Capitol Street Northwest, Suite 379, Washington, D.C. 20001 (202) 393-8159.

Enos, Clive and Sondra Forsyth Enos. "Portrait of the American Woman Today." Ladies Home Journal, January, 1984, pp. 122-128.

Erb, Thomas Owen. "Attitudes of Early Adolescents Toward Science. Women in Science, and Science Careers," Middle School Research, Selected Studies. National Middle School Association, 1981.

Fennema, Elizabeth. "Arts and Mathematics Anxiety." Presentation given at the University of Minnesota, March 1984.

Foreman, Judy. "Wellesley's New President: The Right Woman For the Right Job," Change, April, 1982, pp. 42-46.

Interview with Professor Allen Glenn, Chair, Department of Curriculum and Instruction, 145 Peik Hall, 159 Pillsbury Driver Southeast, University of Minnesota, Minneapolis, MN 55455.

Goldfield, Randy. "New Office: The Entrepreneurs (High Technology Companies Run By Women)," Working Woman, February, 1983, pp. 45-57.

Hanauer, Mark. "A Friendly Frontier for Female Pioneers (Women in Computer and Software Industries)," Fortune, June 25, 1984, pp. 78-86.

Maccoby and Jacklin cited in Sex Differences in Computer Training: Why Do Boys Outnumber Girls? Research Bulletin, Phi Delta Kappa, May 1983.

*Malcolm, Shirley M. "Women-Minorities in Science and Technology," Science, October 9, 1981, p. 137.

Martin, Josh. "Brave New Managers," Working Woman, May, 1983, pp. 100-105.

Meyers, Mike. "3M Engineer Aims to Help Girls Fit into Math Studies Equation," Minneapolis Star and Tribune, July 2, 1984, p. 2M.

Moss, Carol M. "Integrating the Computer Circuit," Citibusiness, May 9, 1984, p. 10.

Mussen, Conger, Kagan. Child Development and Personality, 1969. Harper Row, New York.

O'Connor, Rory J. "Q & A: Ann Winblad," Infoworld, July 11, 1984, p. 66.

Pelcak, Douglas, and L. Sunny Hansen, Director, Project Born Free. Selected Review of the Literature on Career Development and Sex-Role Stereotyping at the Elementary Level. Counseling and Student Personnel Psychology, Department of Psychoeducational Studies, College of Education, University of Minnesota, Minneapolis, MN 55455.

*Phi Delta Kappa, Center on Evaluation, Development and Research. "Sex Differences in Computer Training: Why Do Boys Outnumber Girls?" Research Bulletin, May, 1983.

Rogers, Everett M. and Judith K. Larsen. Silicon Valley Fever: Growth of High Technology Culture. New York: Basic Books, 1984.

*Turecamo, Dorrine. "Education: Visiting Scientists," Working Woman, September, 1983, pp. 116-118.

U.S. Department of Education. The National Institute of Education. Sex Equity in Education. NIE-Sponsored Projects & Publications. Washington: U.S. Government Printing Office, 1981.

"Why Not Womanpower?" Electronics, July 14, 1983, p. 182.

MD:kjyST8-3
05/20/86